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Forest Service

Status and management of scrub habitat on the Ocala National Forest

Landscape Scale Assessment

National Forests in Florida

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Objectives and scope

The purpose of Landscape Scale Assessments (LSAs) is to integrate an evaluation of forest plan implementation with options for future planning and management at a landscape scale. These assessments have traditionally been conducted based on 5th or 6th level hydrologic units. However, in Florida there is very little topographic relief and many resources are not naturally separated by watershed boundaries. Therefore, in this LSA we focus on an imperiled community type – oak and sand pine scrub – across the Ocala National Forest.

The primary objectives of this assessment are to describe the current and desired conditions of scrub on the Ocala National Forest, discuss management actions required to maintain high-quality habitat for rare scrub species, and explore the effects of such activities on key resources. The National Forests in Florida conducted an LSA on scrub in 2008 that provided background for a forest plan amendment modifying scrub management. Therefore, another objective of this report is to update the previous assessment and evaluate the degree of implementation and success of the management actions that it recommended.

Although this assessment may provide a background for developing future project proposals, the general management opportunities described in this document do not constitute proposed actions subject to analysis and public involvement under the National Environmental Policy Act.



Figure 1. Florida scrub-jay (photo by Carrie Sekerak)

Scrub habitats

Florida scrub is a plant community that occurs on both current and ancient coastal sand ridges and is characterized by a suite of species and distinctive vegetation structure. Although their relative abundance varies, typical scrub species include shrubby evergreen oaks (Chapman's oak, myrtle oak, sand live oak and scrub oak), Florida rosemary, several habitat-specific shrubs and small trees, saw palmetto and a sparse cover of herbs and lichens with little grass. Sand pine or south Florida slash pine is often present in the canopy layer with density varying according to site history and soil productivity. Bare sand is common in most high-quality scrub habitats but decreases with vegetation succession and litter accumulation. More information may be found in the Florida Natural Areas Inventory (FNAI) Guide to the Natural Communities of Florida (FNAI 2010, available at http://fnai.org/PDF/NC/Scrub_Final_2010.pdf), in the Ecosystems of Florida (Myers 1990) or in other comprehensive reviews of scrub habitats.



Figure 2. Scrub in Ocala National Forest (photo Jay Garcia).

The Big Scrub on the Ocala NF is the largest remaining contiguous tract of Florida scrub. This community has a canopy of sand pine over as understory/midstory of typical scrub plants. The Ocala sand pine (*Pinus clausa* var. *clausa*) is a relatively small and short-lived species that can grow in dense monospecific stands (Burns and Honkala 1990). Although sand pines are usually killed by fire, the Ocala sand pine is also clearly fire dependent, producing abundant flammable resin during the driest season (Feb.-Mar.), bearing serotinous cones that open and release

seeds in response to fire, and rapidly establishing in post-fire habitats. Sand pines may produce cones in as little as 5yr, are most economically valuable from 35-50yr old and generally fall apart after about 70 years following stand establishment (Outcalt 1997). Shrubs that occur in sand pine scrub include several species of oaks, rosemary, rusty lyonia, and palmetto. Most other components of the plant community are herbaceous species that grow in open patches between the oaks, usually responding positively after timber harvest or fire removes the sand pine canopy, burns any accumulated litter and downed wood and top-kills the oaks (Greenberg et al. 1995, Weekley and Menges 2003). The herbs either disperse seeds into other newly burned patches or lay as dormant seeds or roots for the next several decades until this patch burns or is harvested again (e.g., Hartnett and Richardson 1989). Few species are specific to older sand pine scrub, but some lichens and epiphytes appear to take at least several years to recolonize after fire (Weekley and Menges 2003, Equihua 1989).

Fire and vegetation structure

The composition and structure of scrub vegetation is limited by abiotic conditions (intense sunlight and heat, low water availability, nutrient-poor soils) and shaped by natural disturbances that affect plant species establishment and community succession, including hurricanes, salt spray (for coastal scrubs) and, most importantly, fire. Of these, the historical role of fire is perhaps the most controversial and the most difficult to translate to managing scrub habitats.

The Forest Service generally suppresses wildland fires in scrub because of the catastrophic nature of these fires and the high human population density around the forest. The Forest Service has primarily managed scrub by clearcutting and artificially reseeded sand pine. Most of the above-ground vegetation is harvested or broken, which then quickly regenerates by seed and sprouts. The species composition of the scrub community appears to have remained largely intact despite this switch from wildfire to clearcut as the source of regenerating patches. However, harvest is limited by the age and density of sand pines required to make a timber harvest economically feasible, so this approach to managing scrub promotes even-aged and dense stands of sand pine with relatively less open scrub habitat.

Historical accounts and studies of scrub on the Ocala National Forest provide a framework for understanding past variability and potential future management of this unique habitat. A map produced by the US Army in 1839 describes the scrub areas on the Ocala National Forest as "Oak scrub" or "High Rolling Oak Scrub Country" (Figure 3)

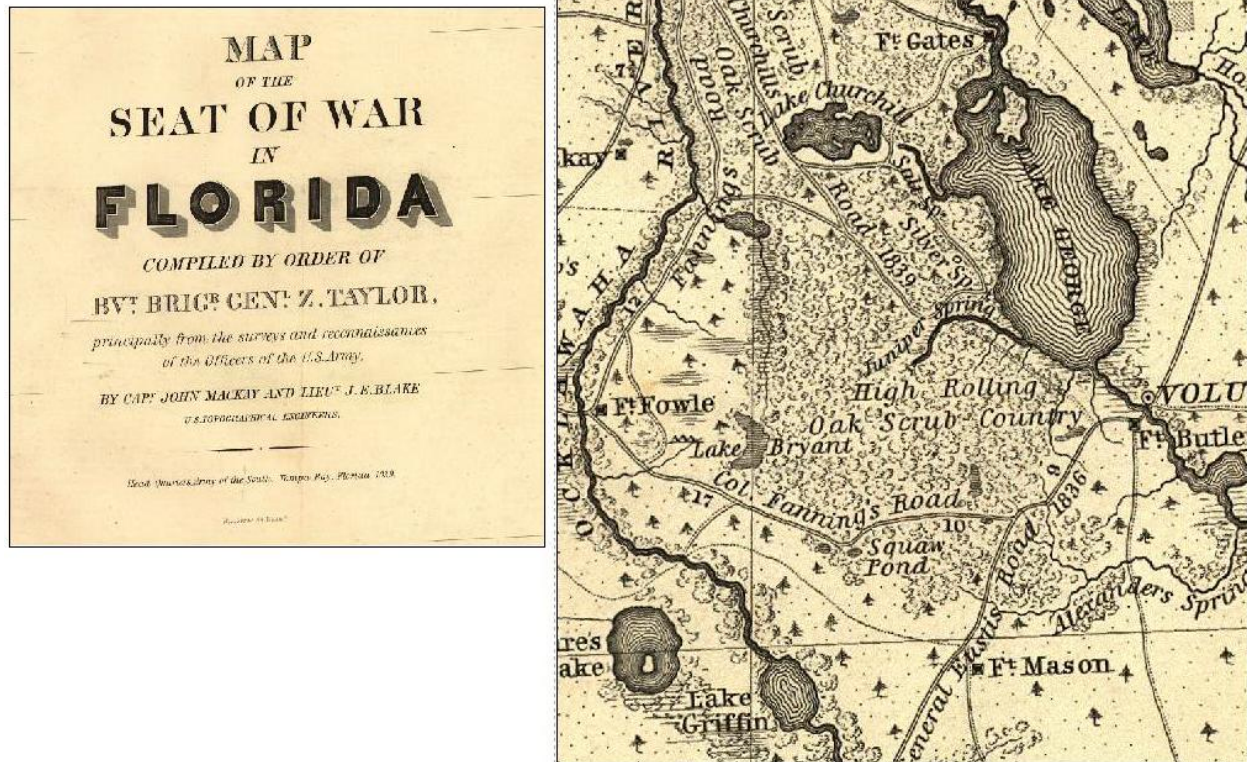


Figure 3. Excerpt of a 1839 US Army map of Florida describing the features and landscape around what is now the Ocala National Forest.

Although this map annotation provides little information, it certainly suggests that the area was dominated by oaks rather than the dense sand pines that were encouraged by fire suppression in the 20th century. This open condition was supported by a review FNAI conducted in 2014 of General Land Office survey records from what is now the Ocala National Forest. Within an area of ~35,000 acres, only 41 survey points out of 142 from 1852 had any pine trees recorded within 20m. Pine density varied widely, suggesting a patchy distribution across the landscape, but the overall estimate derived from the 1852 land surveys was 23 sand pine trees/ha (Gulledge, unpublished data). Additionally, review of land survey records from 1834 and 1849 suggested that more trees were present in 1834 (though still with a patchy distribution) and that much of the area burned in the 1840s.

Nash (1895) described the scrub flora near Eustis, noting the distinct boundary between scrub and sandhill islands. He described sand pine as the only large tree in scrub, and stated that “The great part of the growth in the ‘scrub’ is made up of scrub oaks” (144). He echoed previous observations that “fires are of rare occurrence in the ‘scrub,’ the plants have made no provision against it, and so when a fire does go through it causes great havoc, almost entirely killing the pines and oaks. It is fortunate that fires are of such rare occurrence” (145). Nash goes on to describe many scrub endemic plants that require the bare ground generated and maintained by fire, so there is some inconsistency in his general indictment of fire.

W.F. Hill (1916) produced a report on the land and resources within what is now the Ocala National Forest shortly after its designation as a national forest. The report describes the Big Scrub as a “great sand-waste area.” Hill recognized the scrub as a fire-dependent community, noting that “...fires swept over the landscape in irregular intervals, about once in the lifetime of a sand pine.” However, he also predicted that sand pine would eventually have economic value and recommended protecting the stands from fire to protect the timber resource.

In a widely-cited paper, Webber (1935) described scrub as a fire-fighting association in which the dominance of evergreen shrubs, limited ground cover and distinct boundaries between scrub and more pyrogenic habitats prevent frequent fire. According to Webber, “When a fire gets started in a scrub, which probably can occur only in a very dry season and rather infrequently, it burns with great fury and entirely destroys the tops of all the plants and kills the scrub pines outright” (Webber 1935, p. 348). This account also included reference to the effects of fire as “total destruction” (p. 353). Although Webber offers no quantitative information on fire frequency, he describes the general process of fuel accumulation and vegetation dynamics in the following passage (p. 357):

...where the scrub is old enough, following a previous burning, to have permitted a sufficient accumulation of dead material, a scrub fire ensues. Judging from the appearance of the Etonia scrub [i.e., Big Scrub], fires in it must have been much more common in recent years than formerly. As I remember this scrub when I first studied it, the large spruce pines [i.e., sand pines] were the most conspicuous feature of the flora, their finely branched bushy tops dominating all over the main part of the scrub. Now it is only here and there in the great extent of the scrub that one sees a small patch of the large trees, which through some accident have escaped the destruction of the fires. The young pines are common all over the area even now, but the oaks dominate the vision.

Webber further suggests that habitat changes due to logging, turpentine production, road building and invasive plants all threatened the scrub by increasing the likelihood of fire. Notably, however, Webber described the rapid regrowth of scrub following fire and even the long unburned areas he described were quite open, as demonstrated by a photograph in his paper captioned as “scrub not recently burned over” (p. 358):

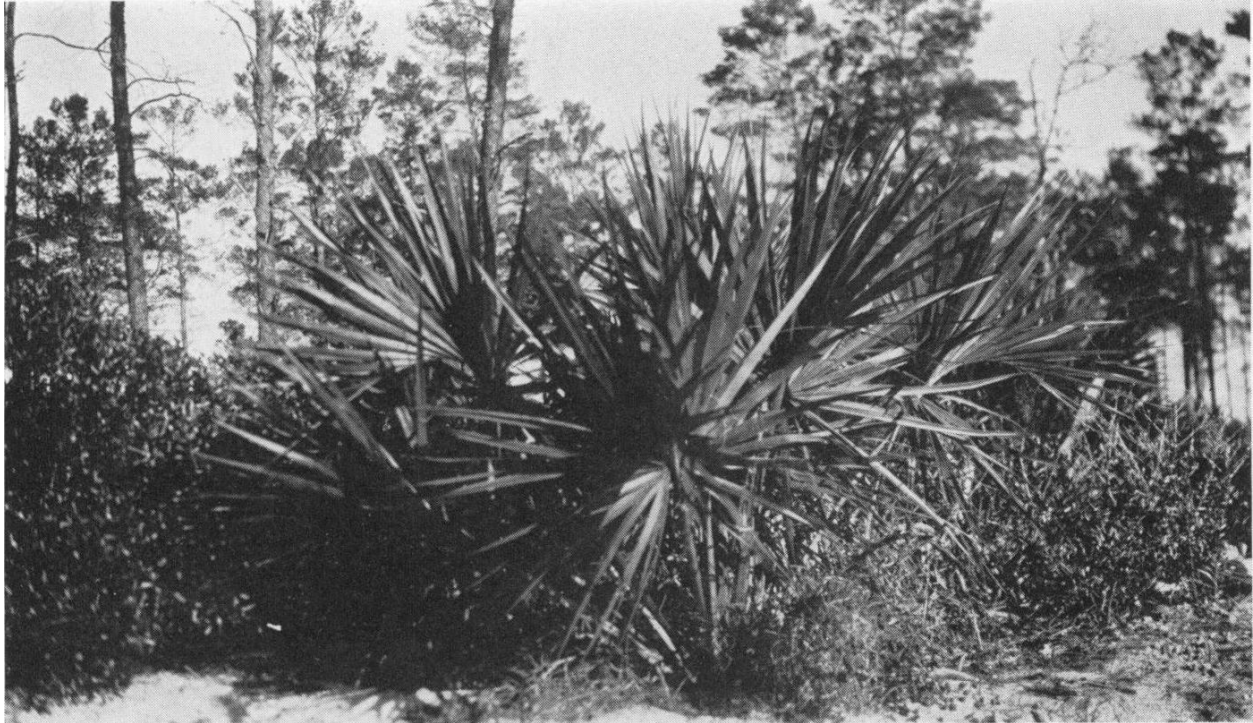


Figure 4. Photograph from Webber (1935) showing sand pine density without artificial seeding.

Given other accounts of scrub vegetation structure and fire dynamics, it is worth questioning Webber's assumption that the large stands of older sand pine he recalled from earlier experiences were more typical than the smaller pine patches and higher proportion of oak that he found later. As such, Webber's observations are probably most helpful for expanding our understanding of the historical range of variation of the Big Scrub, in which the density and contiguity of sand pine stands likely showed substantial spatial and temporal heterogeneity in response to periodic fires that varied size, season, return interval and intensity. A great irony of Webber's description of the scrub as a fire-fighting association is that the same year his paper was published, an extremely fast-moving wildfire ran 36 miles through the Ocala National Forest, crossing multiple firebreaks and burning 35,000 acres of scrub in 4 hours (Sekerak and Hinchey 2001).

More recent studies of scrub vegetation dynamics, population ecology of scrub species and fire effects have added to our understanding of the role of fire in sand pine scrub habitats:

- In a multi-decade study of wildfires in the Ocala National Forest, Hough (1973) found that most fires occurred during dry and windy conditions between February and June (peaking in May), including 80% of those that burned more than 10 acres. Hough reported that 168 wildfires occurred during a 10-yr period from 1961 to 1970, though only two exceeded 100 acres burned.
- In a thorough description of scrub systems, Myers (1990) emphasized that scrub habitats are maintained by fire, but that "The role of fire in scrub is far more complicated than usually portrayed and the patterns created are varied" (p. 170). Overall, he

suggested that high-intensity fires occurring at 10 to 100 year intervals are required to regenerate scrub habitats depending on site productivity and vegetation structure.

- In May 1993, the Ocala National Forest conducted a stand-replacing prescribed fire in a mature sand pine stand (Custer and Thorsen 1996). Initial vegetation responses indicated that the intense fire benefited early successional scrub species, including the scrub endemic *Bonamia grandiflora*.
- In a series of studies on a range of taxa, Greenberg and colleagues found many similarities in biotic responses to mechanical treatment (chopping) and fire in post-harvest sand pine stands. Notably, these studies lacked a burn only treatment. Greenberg et al. (1995, p. 161) concluded that “Clear-cutting may be a viable approach to ecosystem management of sand pine scrub vegetation where a natural disturbance regime is impractical. This may be suitably applied in small patches of scrub surrounded by urban development, or where timber harvesting and ecosystem management for vegetation are dual management objectives.”
- In a review of fire effects on scrub plant demography, Menges (2007) suggested fire intervals of 15-30 years for rosemary scrub and 5-12 years for scrubby flatwoods. He did not provide an estimate for sand pine scrub, but did note that these estimates derived from life history of rare scrub plants are less than those published elsewhere. Several of the species in his review are restricted to the Lake Wales Ridge in southern Florida but several others occur in sand pine scrub on the Ocala National Forest
- Menges and Gordon (2010) reviewed the effects of fire and mechanical treatments in Florida ecosystems, including scrub, suggesting that the effects of logging, chopping or similar mechanical removal of vegetation has many similarities to the effects of fire. However, some studies found that the soil disturbance associated with logging or other mechanical treatments disrupted the plant community and that repeated chopping could reduce saw palmetto, which is among the more flammable components of scrub vegetation. When attempting to restore degraded sites, they suggest that “Mechanical and herbicide treatments should be used only in the initial phases of ecosystem restoration, and should be followed by prescribed fire. If repeated prescribed fires are not used, then the positive effects of the initial mechanical treatments or herbicides may be lost due to vigorous recovery of resprouting species” (p. 167-168).
- In a summary of scrub natural history and management, FNAI (2010) suggested a variable 5-40 year fire interval applied in a mosaic across the landscape for maintaining high quality sand pine scrub.
- Godwin and Kobziar (2011) documented fire severity of two wildfires that burned in the Ocala National Forest Juniper Prairie Wilderness, including less severe burning of many scrub stands after only a 3yr post-fire interval. Based on vegetation sampling after the second fire, they suggest that short-interval fires result in loss of sand pine whereas single, high-intensity fires in mature stands of sand pine result in high density of sand pine saplings.

As demonstrated by the diverse observations, speculation and results described above, summarizing our knowledge of fire and vegetation dynamics in sand pine scrub is challenging. Applying what we know about fire in scrub habitats to management activities largely depends on

how much of the natural range of variation is desired or achievable on managed landscapes. One approach to organize available data is to ask what management activities applied to current conditions would most likely support certain outcomes. For example, if the goal is perpetuation of dense, economically valuable sand pine stands, the best management program is probably timber harvest every 35-50yr followed by site preparation (which may include prescribed fire to clear woody debris and stimulate cones to open) and artificial seeding if sand pine regeneration is not sufficient. Conversely, if the goal is to perpetuate more open, oak-dominated scrub habitats, harvest or stand-replacing fire followed by mechanical vegetation removal and more frequent fire (i.e. 10-15yr intervals or as the fuels allow) are more likely to be successful. Either management approach will create habitat for rare species that prefer early successional scrub, though the latter would likely provide more temporally and spatially connected habitat.

Florida scrub jays

Although many species are closely associated with or even restricted to scrub habitats, the Florida scrub jay (*Aphelocoma coerulescens*) is the most widely recognized and is the focus of the most management attention. Florida scrub-jays are the only bird species endemic to the state and are listed as threatened under the Endangered Species Act of 1973 due to dramatic declines in population size and suitable scrub habitat (USFWS 1990). Menges and Gordon (2010) specifically recommended against blindly using scrub jays as an umbrella species for managing peninsular scrub in Florida. However, many other rare scrub species have similar preferences for open, early successional scrub habitat so managing for preferred scrub jay habitat is a relatively straightforward general approach to promoting high quality scrub (FNAI 2010, USFWS 1999).

The Florida scrub jay is restricted to scattered, often small and isolated, patches of sand pine scrub, xeric oak scrub, scrubby flatwoods, and coastal strand in peninsular Florida. They have very specific habitat requirements and avoid wetlands and forests, including canopied sand pine stands. Optimal scrub-jay habitat is dominated by shrubby scrub live oaks, myrtle oaks, or scrub oaks from 3 to 6 feet tall covering 50-90 percent of the area; bare ground or sparse vegetation covering 10-50 percent of the area; and scattered larger trees, with no more than about 20 percent canopy cover (USFWS 1990, 1999). Florida scrub jays are territorial and breed cooperatively, with a pair and helpers defending approximately 25 acres of habitat.

Primary food sources on the ONF include acorns, palmetto berries, blueberries, lizards, and insects. Scrub oaks produce mast just a few years after fire or harvest, with acorns most abundant in stands age 3 to 7 years. Acorn production is higher in stands with sparse sand pine than in fully stocked stands. Acorns can be a year-round food source if adequate supplies are cached in open sandy areas interspersed among the shrubs. Soft mast and insects are important seasonal foods.

Habitat management for scrub-jays on the Ocala National Forest has primarily been accomplished as a by-product of even-aged sand pine harvest. Mechanical vegetation removal may provide many important habitat elements, most importantly appropriate vegetation structure, where prescribed burning is inadvisable such as in Wildland Urban Interface areas. However, recent reviews emphasize the importance of prescribed fire for maintaining the full suite of natural successional processes in scrub (Menges and Gordon 2010, Boughton and Bowman 2011). Given the large range in historical fire interval for sand pine scrub (i.e., 10-100yr, Myers 1990) and variation in sand pine density and site productivity, optimal fire

frequency for scrub jay management in this habitat should be based on vegetation structure rather than time since the last fire.

Population status

Habitat degradation and destruction have continued to reduce scrub jay populations since federal listing. A recent review of all managed lands with data available found that scrub jay populations declined at least 25% between 1993 and 2011 (Boughton and Bowman 2011). Notably, because no reliable population estimates were available from the Ocala National Forest, this largest tract of scrub was not included in their review despite accounting for nearly 2/3 of the estimated 350,000 acres of potential scrub jay habitat throughout the state.

Boughton and Bowman did not include the Ocala National Forest population in their review because no site-wide surveys have been conducted. However they recognize the current and future role of the forest for scrub jay recovery, noting that “Virtually all of the potential habitat ... could support FSJs if it were not simultaneously being managed for forest production” and that its importance “cannot be overstated” (p. 4).

Scrub jay population estimates for the Ocala National Forest have been developed based on sampling a subset of stands and extrapolating based on observed presence and area of similar habitat. Methods and results from 2001-2006 are presented in the 2008 landscape scale assessment. In 2011, the Forest Service began a more rigorous evaluation of survey methods with the Florida Fish and Wildlife Conservation Commission (Miller 2015). This effort reaffirmed that scrub jays prefer young stands, with highest density in 7-9yr old stands. The density estimates from this study and the current distribution of suitable habitat yield a forest-wide population estimate of 1,100 to 1,250 Florida scrub jay groups.

Forest Plan direction

Scrub habitats on the Ocala National Forest were recognized in the National Forests in Florida Land and Resource Management Plan (i.e., the Forest Plan; USDA 1999) as both a valuable timber resource and as a unique system inhabited by many rare species. Notably, scrub management has also been the subject of more amendments to the Forest Plan than management of any other major habitat type, largely to provide direction and tools for creating larger and more connected areas of early successional scrub habitat.

The following Forest Plan goals and objectives (USDA 1999, p. 2.3-2.6) are related to scrub habitats and management:

Goal 6. Maintain or, where necessary, restore ecosystem composition, structure, and function within the natural range of variability in all ecosystems, with emphasis on longleaf pine-wiregrass, sand pine-oak scrub, pine flatwoods, hardwood/cypress, oak hammock ecosystems and other imperiled specialized communities.

Goal 8. Conserve and protect important elements of diversity—such as endangered and threatened species habitat, declining natural communities, and uncommon biological, ecological, or geological sites.

Goal 9. Manage for habitat conditions to recover and sustain viable populations of all native species, with special emphasis on rare species.

Goal 10. Apply prescribed burning technology as a primary tool for restoring fire's historic role in ecosystems.

Objective 9. Maintain a dynamic system of at least 45,000 to 55,000 acres of habitat capable of supporting scrub-jays on the Ocala NF. The 10-year population objective is 742 to 907 groups.

Objective 19. Regenerate between 39,000 and 41,000 acres of sand pine on the Ocala NF.

The Forest Plan designated Management Areas (MAs) to establish desired conditions and provide management guidance for specific resources and geographical areas. Four MAs specifically addressed scrub management: 8.1 (Sand pine, natural regeneration, large openings), 8.2 (Sand pine, mixed regeneration, moderate openings), 8.4 (Scrub-jay management area) and 9.1 (Pinycastle bombing range). Forest plan amendment 8 incorporated MA 8.1 into MA 8.2 and revised management direction for these areas. The revised desired condition for MA 8.2 is the following (USDA 1999, replacement p. 4.46):

The overall desired condition is a landscape of large, regular shaped patches designed to reduce edge and fragmentation of the landscapes as well as to facilitate the use of prescribed fire. Connectivity of young patches is emphasized to promote movement of scrub-jay and other species such as the sand skink and scrub lizard.

Approximately one-fifth of the area contains openings up to 800 acres scattered across the landscape, creating a mosaic of different aged stands that vary over time. Many [sand pine] seedlings are the result of natural regeneration, although artificial regeneration is usually needed to achieve minimum stocking requirements. Seedlings are usually not discernible as rows and their density can be variable from site to site. About 10 percent of the stands may be left to grow older. In these, trees start to lean and some die, giving the stand an increasingly open, crooked, and picturesque look, as well as providing an important habitat component for a variety of species. Each opening of up to 800 acres provides contiguous suitable habitat for 20-25 Florida scrub-jay territories. An opening may be defined as a contiguous area of multiple stands of different sizes, but each within 0-6 years of stand establishment.

Forest plan amendment 8 also revised the management direction for MA 8.4 to reflect recent scientific research on scrub-jay habitat preferences (USDA 1999, replacement p. 4.47):

In this area, the vegetation patterns consist of a mosaic of oak scrub patches. Patch sizes are generally governed by the presence of effective burning boundaries, but may be as large as 800 acres. Each patch is burned as needed to ensure that 70% of the patch has oaks 3-6 feet tall and to expose bare sand on the ground. The area looks different from the sand pine scrub in other management areas, because this area has only a very low density of sand pine overstory. Sand pine is deliberately removed by clearcutting, followed by frequent prescribed burns that kill sand pine seedlings as they try to establish. These conditions remain suitable for Florida scrub-jays for the next 15 to 20 years, but they gradually deteriorate as the shrubs fill in and the bare sand becomes covered with litter. At this point, the patch is burned to reset the conditions for the scrub-jay and other species. Evidence of plowed fire lines around previous fires is frequently encountered. The landscape is rarely interrupted by narrow road corridors.

Based on analysis of scrub jay stand occupancy data collected on the Ocala National Forest, amendment 8 also revised the successional stage of stands considered suitable from 3-15yr to 3-12yr after harvest. However, this age range is only a surrogate for suitable vegetation structure; many stands that have been seeded with sand pine become unsuitable in as little as 8-9 years after harvest due to rapid growth and high density of young sand pines (Figure 5).



Figure 5. Recently harvested stand on the Ocala National Forest with dense sand pines reducing open ground and growing over oaks that would otherwise provide potential nesting habitat for scrub jays (photo by Jay Garcia)

Conversely, regularly burned scrub may maintain an open vegetation structure suitable for scrub jays and other habitat-specialist species for substantially longer than 10 years (Schmalzer and Adrian 2001).

Current habitat conditions and recent trends

The Ocala National Forest consists of approximately 360,000 acres of federally managed land in north-central peninsular Florida. Almost two-thirds of the area (approximately 229,000 acres) is classified as sand pine scrub or oak scrub. Scrub stands occur in most of the Management Areas, but most are located in four MAs: 0.2 Wilderness (11,778 acres), MA 8.2 Sand pine, mixed regeneration, moderate openings (198,562 acres), MA 8.4 Scrub jay management (2,870 acres) and MA 9.1 Pinecastle bombing range (5,339 acres). Most of the scrub (206,000 acres) is classified as sand pine scrub due to the presence of an overstory of that species, whereas the remaining area (23,000 acres) is classified as oak scrub (Figure 4).

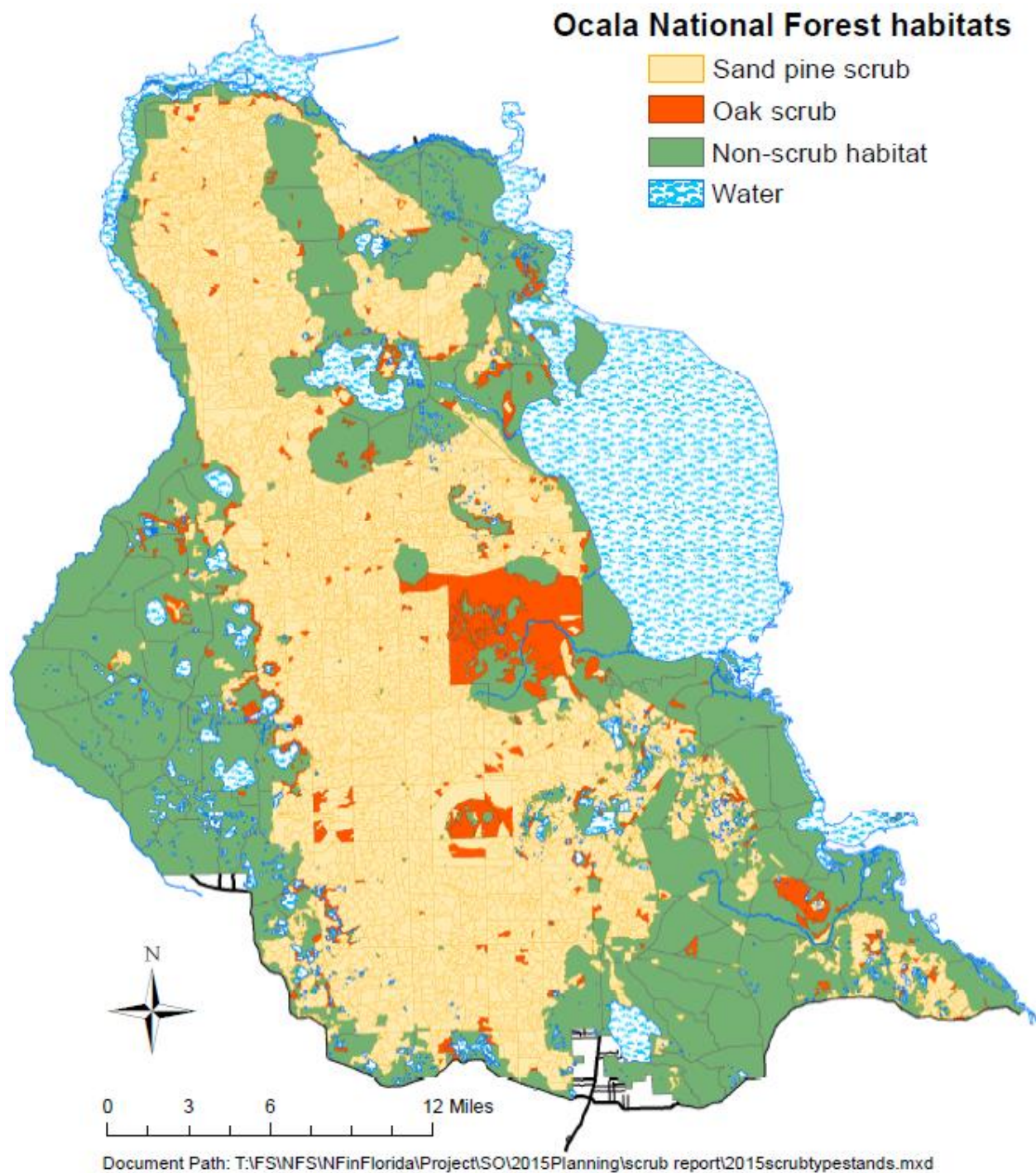


Figure 6. Distribution of vegetation types in Ocala National Forest's Big Scrub.

As described above, creating large areas early successional habitat suitable for Florida scrub-jays has been one of the primary factors affecting scrub management goals in the forest plan as well as changes in scrub management allowed by subsequent plan amendments. The 2008 landscape scale assessment found that forest plan goals and objectives for scrub and scrub jay management were not being met and included several suggestions for future action. Forest plan amendment 8 authorized these changes in management, and implementation of scrub projects has focused on creating larger areas of 3-12yr old scrub by creating larger opening sizes and attempting to harvest stands adjacent to current habitat. Figure 5 shows trends in suitable scrub jay habitat (scrub stands 3-12yr old) from 2008 to 2018, which is the furthest in the future that can be accurately projected based on past harvest of sand pine. Note that the habitat area for 2018 is based on estimated harvests completed in 2015 so may be less accurate than the other years.

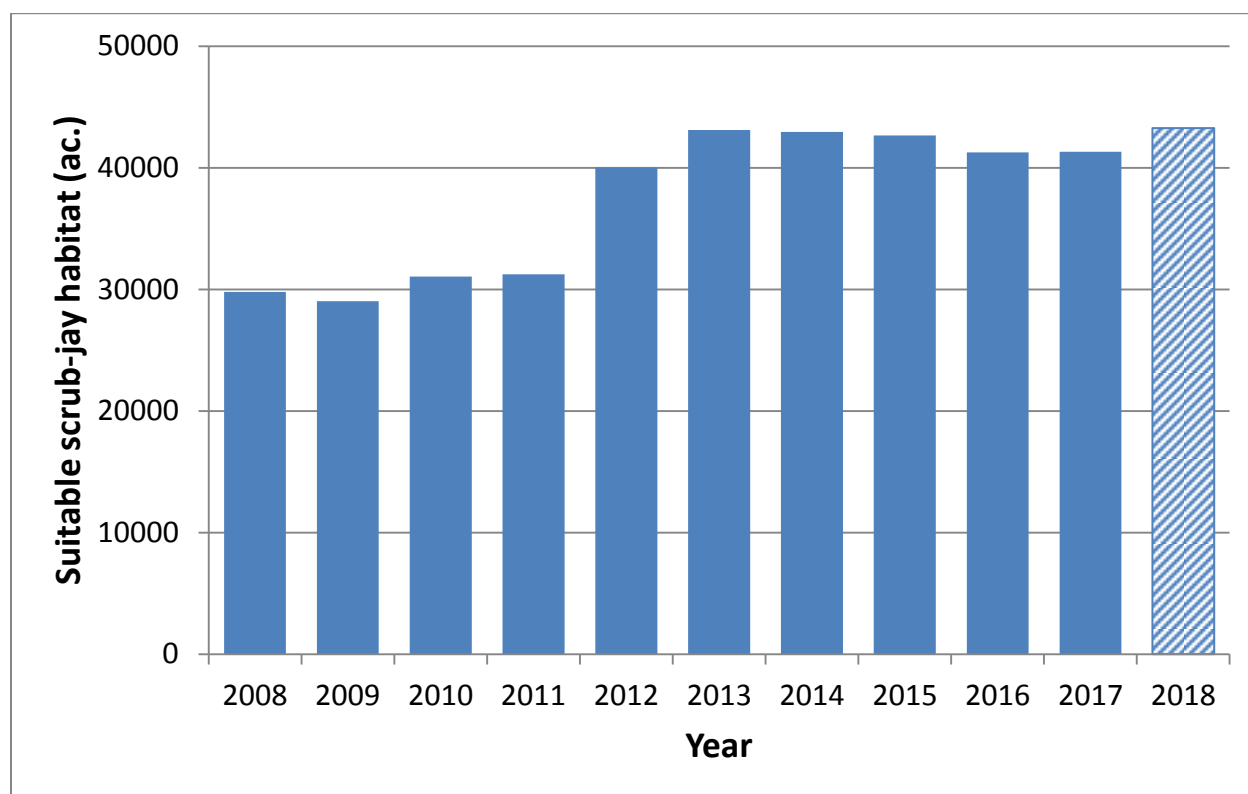


Figure 7. Area of suitable scrub jay habitat from the 10yr period 2008-2018.

Although the total amount of suitable scrub jay habitat is perhaps the most important measure of management success, the size and connectivity of patches is also relevant for this species. Table 1 shows trends in several measures of scrub jay habitat calculated from dissolved polygons of suitable habitat (i.e., contiguous stands of suitable habitat were considered as a single polygon even if they were different ages within the 3-12yr range).

Table 1. Scrub jay habitat metrics.

Year	Habitat measures			
	Total suitable habitat (ac.)	No. of patches	Mean patch size (ac.)	Patches >800ac.
2008	29,778	411	72.5	2
2009	29,009	391	74.2	2
2010	31,039	398	78	1
2011	31,239	399	78.3	2
2012	40,018	390	102.6	3
2013	43,108	381	113.1	5
2014	42,928	387	110.9	4
2015	42,662	385	110.8	4
2016	41,267	331	124.7	6
2017	41,298	305	135.4	6

The total amount of suitable scrub jay habitat is larger now than in 2008, but most of the increase is due to the addition of several thousand acres of habitat in 2012 as the scrub from the 2006 and 2009 Juniper Prairie Wilderness wildfires grew into the 3-12yr old age range. However, other metrics indicate that shifting management has been successful in improving scrub jay habitat, as shown by a reduction in the total number of suitable patches and an increase in both the mean size of patches and the number of patches over 800 ac. Many of these patterns are shown in the map below of scrub habitat age across the Ocala National Forest.

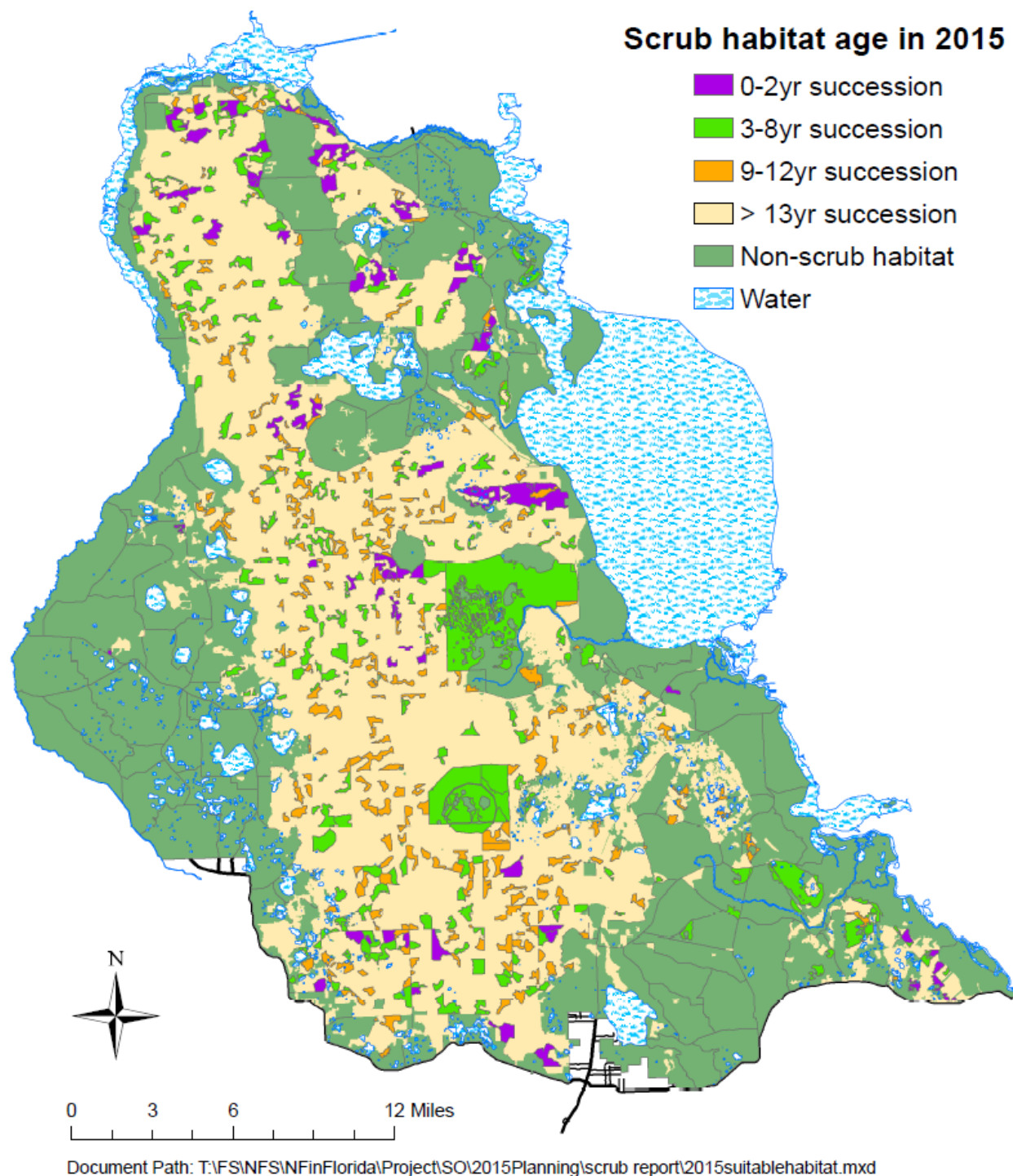


Figure 8. Spatial distribution of suitable scrub jay habitat, divided by successional stage.

Designation of additional MA 8.4 has largely achieved the desired purpose of maintaining early successional scrub habitat. Although both the Juniper Prairie Wilderness and Pinecastle bombing range currently (2015) have a higher proportion of 3-12yr old scrub (71% and 78% of the MA area, respectively), approximately 29% of the land in MA 8.4 is currently suitable for

scrub jays with an additional 17% in the 0-2yr old range. By contrast, only 14% of MA 8.2 is currently suitable for scrub jays with 4% more in the 0-2yr old range. After being harvested and either chopped or burned (or both), there is no requirement to reforest sand pine stands in MA 8.4. In the past two years several areas in MA 8.4 have been harvested, chopped, and then burned a year or two later to remove woody debris and kill seedling sand pines (Figure 9). Evidence from short-interval wildfires in the Juniper Prairie Wilderness and frequent prescribed fires in the Pinecastle Bombing Range suggests that stands managed with this sequence of activities will have lower sand pine density and, consequently, are more likely to maintain vegetation structure suitable for scrub jay breeding and foraging longer than 9-12 years.



Figure 9. Burning recently harvested and chopped scrub in MA 8.4 on the Ocala National Forest (photo by Carrie Sekerak).

By contrast, harvest and site preparation in MA 8.2 is designed to encourage sand pine recruitment, and inadequate recruitment requires artificial regeneration through seeding to meet stocking levels required by the Forest Plan and National Forest Management Act.

Management challenges and opportunities

The Ocala National Forest contains by far the largest contiguous tract of scrub in the state and, therefore, the Forest Service has a unique role in the perpetuation of scrub habitat and the rare species it supports. Amendments to the Forest Plan and thoughtfully designed project-level management activities have contributed to larger areas and better connected early successional scrub habitat. The wildlife and fire staffs on the Ocala National Forest have increased efforts to burn scrub in MA 8.4 and the forest management staff has attempted increase harvest sizes and to minimize seeding areas of clearcut sand pine in MA 8.2. These efforts appear to have been largely successful in maximizing the potential for timber management to contribute to rare species conservation and recovery. Additionally, wildfires in 2006 and 2009 created large amounts of early successional scrub in the Juniper Prairie Wilderness.

However, there is also a fundamental contradiction between managing sand pine for timber harvest and managing for rare scrub species: to make sand pine production economically viable, the stands must be very dense and optimal harvest should occur near the culmination of mean annual diameter growth (~35yr). Management activities required to meet these requirements produce stands that quickly grow out of optimal scrub jay habitat and then remain unsuitable for at least 15-25yr before the next harvest. Within the current limitations, even modest increases in the area of sand pine harvested would not result in the Forest Plan objective of maintaining 45,000 to 55,000 acres of habitat suitable for scrub jays. Indeed, with over 1/3 of current suitable habitat (15,000ac.) in the 9-12yr range and only 8,700ac. in the 0-2yr range, the amount of nominally suitable habitat will likely decline in the near future without management changes.

Nevertheless, the recent scrub jay population estimate of 1,100-1,250 groups on the forest is nearly equal to the population estimate reported by Boughton and Bowman (2011) for all other 198 sites with recent survey data. Simply put, recovery of this species depends largely on how potential habitat is managed in the Ocala National Forest. Although supporting such a large proportion of a declining species is certainly valuable, it is worth considering how the forest could contribute even more to long-term viability of scrub jays and other scrub species. Under the current Forest Plan only 1.2% of the scrub is managed primarily for Florida scrub jays and other rare species that require open, early successional scrub habitat (i.e. the 2,870 ac. in MA 8.4). An additional 7.4% (17,000 ac.) in MAs 0.2 and 9.1 provide an inordinate proportion of suitable 3-12yr old scrub jay habitat but these areas are primarily managed for other purposes (i.e., wilderness characteristics and military exercises, respectively). By contrast, the remaining 199,000 ac. of scrub in MA 8.2 is managed primarily for sand pine timber production with important, but secondary, considerations for high-quality early successional habitat.

Options for increasing scrub jay habitat

Based on the ecology of Florida scrub, current conditions on the Ocala National Forest and management limitations related to prescribed fire safety and timber production, the following options for future scrub jay management seem most likely to be successful:

- **Increase area designated as MA 8.4.** The desired conditions and management guidelines in this Management Area were developed to prioritize scrub jay habitat. A general sequence of management actions in these areas is a final harvest of sand pine, chopping the slash and shrubs then burning the area to reduce sand pine recruitment

and create bare ground areas. Almost ½ of the area currently designated as MA 8.4 is suitable for nesting or foraging (i.e., 0-12yr post-harvest/burn). As the remaining mature sand pine stands are harvested, however, approximately 70% of the area in MA 8.4 should provide suitable vegetation structure for scrub jay nesting habitat and much of the remaining area would be suitable for foraging but the vegetation would be too short for nesting.

- **Develop an adaptive management strategy for managing succession in MA 8.4.** After 8-15 years following the initial harvest and burn, stands in MA 8.4 will become unsuitable for scrub jays as oaks grow taller and denser and bare sand is vegetated or shaded. A recent model of scrub jay habitat management from Merritt Island National Wildlife Refuge suggested that maintaining optimal habitat requires reducing oak height (through fire or mechanical means) before a majority of the stand becomes unsuitable for scrub jay nesting (Johnson et al. 2011). Unfortunately, we have relatively little experience in returning stands to an early successional stage without first conducting a commercial timber harvest. Mechanical vegetation removal such as chopping or mowing followed by prescribed fire may be a useful tool for these stands that are growing out of suitable scrub jay habitat but are not dense enough or old enough to be harvested. Custer and Thorsen (1996) demonstrated that stand-replacing prescribed fire may be conducted safely given appropriate fuel and weather conditions and fire is much more economically efficient than heavy equipment. However, prescribed fire in scrub is challenging and potentially risky due to the paradox that scrub is difficult to ignite but often burns uncontrollably when fire does start. By sharing information and resources with other agencies and organizations, experimenting with smaller stands and burning into large firebreaks, we should develop a strategy for determining when fuels will allow prescribed fire and work to better understand the prescriptions that will allow fire to safely achieve the desired effects in these areas.
- **Continue using frequent prescribed fire in the Juniper Prairie Wilderness and Pinecastle bombing range.** These two areas currently comprise a disproportionately high amount of suitable scrub jay habitat. The bombing range is frequently burned to allow military exercises, but the contribution of the wilderness area to scrub jay habitat was due to large, overlapping wildfires in 2006 and 2009. We have experience using prescribed fire in both of these areas and have evidence that the fuels in the wilderness may support relatively frequent, patchy fires that generate a high-quality mosaic of habitats.
- **Continue to maximize scrub jay habitat in MA 8.2.** Even with reforestation requirements that result in a relatively shorter window of optimal habitat, a substantial proportion of scrub jay habitat has been created through sand pine harvest in MA 8.2. Recent efforts to connect recently harvested stands have generated larger, more contiguous areas of suitable habitat. By continuing these efforts, timber sales will continue to play an important role in providing early successional scrub habitat that links larger habitat areas across the landscape (i.e., MA 8.4, wilderness and bombing range), promoting colonization and gene flow for early successional scrub species.

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